

N. Nashed

RAW SEQUENCE LISTING
PATENT APPLICATION: US/09/367,013B
DATE: 03/05/2001
TIME: 10:52:15

Input Set : A:\ES.txt
Output Set: N:\CRF3\03052001\I367013B.raw

ENTERED

See p. 5

TECH CENTER 1600/2900

MAR 13 2001

RECEIVED

3 <110> APPLICANT: DEBORAH, KNUTZON
4 MUKERJI, PRADIP
5 HUANG, YUNG-SHENG
6 THURMOND, JENNIFER
7 CHAUDHARY, SUNITA
8 LEONARD, AMANDA
10 <120> TITLE OF INVENTION: Methods and Compositions for Synthesis of Long Chain Polyunsaturated
11 Fatty Acids
13 <130> FILE REFERENCE: CGAB-210 USA
15 <140> CURRENT APPLICATION NUMBER: US 09/367,013B
C--> 16 <141> CURRENT FILING DATE: 1999-08-15
18 <150> PRIOR APPLICATION NUMBER: US 08/834,655
19 <151> PRIOR FILING DATE: 1997-04-11
21 <160> NUMBER OF SEQ ID NOS: 40
23 <170> SOFTWARE: PatentIn version 3.0
25 <210> SEQ ID NO: 1
26 <211> LENGTH: 1617
27 <212> TYPE: DNA
28 <213> ORGANISM: Mortierella alpina
30 <220> FEATURE:
31 <221> NAME/KEY: misc_feature
32 <222> LOCATION: ()..()
33 <223> OTHER INFORMATION: Description of Combined DNA/RNA Molecule: Delta-6 Desaturase
34 Nucleic Acid Sequence
37 <400> SEQUENCE: 1
38 cgacactcct tccttcttct caccgcctct agtccccctc aacccccctc ttgacaaaag 60
40 acaacaaacc atggctgctg ctcccagtggt gaggacgttt actcggggccg aggtttttgaa 120
42 tgccgaggct ctgaatgagg gcaagaagga tgccgaggca cccttcttga tgatcatcga 180
44 caacaagggt tacgatgtcc gcgagttcgt ccctgatcat cccggtggaa gtgtgattct 240
46 cagcgacgtt ggcaaggacg gcaactgacgt ctttgacact ttccaccccg aggtctgcttg 300
48 ggagactctt gccaaactttt acgtttggtga tattgacgag agcgaccgcg atatcaagaa 360
50 tgatgacttt gcggccgagg tccgcaagct gcgtaccttg ttccagtctc ttgggttacta 420
52 cgattcttcc aaggcatact acgccttcaa ggtctcgttc aacctctgca tctgggggttt 480
54 gtcgacggtc attgtggcca agtggggcca gacctcgacc ctgcaccaag tgctctcggc 540
56 tgcgcttttg ggtctgttct ggcagcagtg cggatggttg gctcacgact ttttgcatca 600
58 ccaggctctc caggaccgtt tctgggggtga tcttttcggc gccttcttgg gaggtgtctg 660
60 ccagggtctc tcttctctgt ggtggaagga caagcacaac actcaccacg ccgcccccaa 720
62 cgtccacggc gaggatcccg acattgacac ccacctctg ttgacctgga gtgagcatgc 780
64 gttggagatg ttctcggatg tcccagatga ggagctgacc cgcatgtggt cgcgtttcat 840
66 ggtcctgaac cagacctggt tttacttccc cattctctcg tttgcccgtc tctcctggtg 900
68 cctccagtc attctctttg tgcctcctaa cggtcaggcc cacaagccct cgggcgcgcg 960
70 tgtgcccata tctgttggtc agcagctgtc gcttgcatg cactggacct ggtacctcgc 1020
72 caccatgttc ctgttcatca aggatcccggt caacatgctg gtgtactttt tgggtgtcga 1080
74 ggcgggtgtc ggaactttgt tggcgatcgt gttctcgtc aaccacaacg gtatgcctgt 1140
76 gatctcgaag gaggaggcgg tcgatattga tttctcacg aagcagatca tcacgggtcg 1200
78 tgatgtccac ccgggtctat ttgccaaactg gttcacgggt ggattgaact atcagatcga 1260
80 gcaccacttg ttcccttcga tgcctcgcca caacttttca aagatccagc ctgctgtcga 1320

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82 gaccctgtgc aaaaagtaca atgtccgata ccacaccacc ggtatgatcg aggggaactgc 1380
84 agagggtcttt agccgtctga acgagggtctc caaggctgcc tccaagatgg gtaaggcgca 1440
86 gtaaaaaaaaa aaacaaggac gttttttttc gccagtgccgt gtgcctgtgc ctgcttccct 1500
88 tgtcaagtcg agcgtttctg gaaaggatcg ttcagtgag tatcatcatt ctccttttac 1560
90 cccccgtca tatctcattc atttctctta ttaaacaact tgttcccccc ttcaccg 1617
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94 <211> LENGTH: 457
95 <212> TYPE: PRT
96 <213> ORGANISM: Mortierella alpina
98 <400> SEQUENCE: 2
100 Met Ala Ala Ala Pro Ser Val Arg Thr Phe Thr Arg Ala Glu Val Leu
101 1 5 10 15
103 Asn Ala Glu Ala Leu Asn Glu Gly Lys Lys Asp Ala Glu Ala Pro Phe
104 20 25 30
106 Leu Met Ile Ile Asp Asn Lys Val Tyr Asp Val Arg Glu Phe Val Pro
107 35 40 45
109 Asp His Pro Gly Gly Ser Val Ile Leu Thr His Val Gly Lys Asp Gly
110 50 55 60
112 Thr Asp Val Phe Asp Thr Phe His Pro Glu Ala Ala Trp Glu Thr Leu
113 65 70 75 80
115 Ala Asn Phe Tyr Val Gly Asp Ile Asp Glu Ser Asp Arg Asp Ile Lys
116 85 90 95
118 Asn Asp Asp Phe Ala Ala Glu Val Arg Lys Leu Arg Thr Leu Phe Gln
119 100 105 110
121 Ser Leu Gly Tyr Tyr Asp Ser Ser Lys Ala Tyr Tyr Ala Phe Lys Val
122 115 120 125
124 Ser Phe Asn Leu Cys Ile Trp Gly Leu Ser Thr Val Ile Val Ala Lys
125 130 135 140
127 Trp Gly Gln Thr Ser Thr Leu Ala Asn Val Leu Ser Ala Ala Leu Leu
128 145 150 155 160
130 Gly Leu Phe Trp Gln Gln Cys Gly Trp Leu Ala His Asp Phe Leu His
131 165 170 175
133 His Gln Val Phe Gln Asp Arg Phe Trp Gly Asp Leu Phe Gly Ala Phe
134 180 185 190
136 Leu Gly Gly Val Cys Gln Gly Phe Ser Ser Ser Trp Trp Lys Asp Lys
137 195 200 205
139 His Asn Thr His His Ala Ala Pro Asn Val His Gly Glu Asp Pro Asp
140 210 215 220
142 Ile Asp Thr His Pro Leu Leu Thr Trp Ser Glu His Ala Leu Glu Met
143 225 230 235 240
145 Phe Ser Asp Val Pro Asp Glu Glu Leu Thr Arg Met Trp Ser Arg Phe
146 245 250 255
148 Met Val Leu Asn Gln Thr Trp Phe Tyr Phe Pro Ile Leu Ser Phe Ala
149 260 265 270
151 Arg Leu Ser Trp Cys Leu Gln Ser Ile Leu Phe Val Leu Pro Asn Gly
152 275 280 285
154 Gln Ala His Lys Pro Ser Gly Ala Arg Val Pro Ile Ser Leu Val Glu
155 290 295 300
157 Gln Leu Ser Leu Ala Met His Trp Thr Trp Tyr Leu Ala Thr Met Phe

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158 305          310          315          320
160 Leu Phe Ile Lys Asp Pro Val Asn Met Leu Val Tyr Phe Leu Val Ser
161          325          330          335
163 Gln Ala Val Cys Gly Asn Leu Leu Ala Ile Val Phe Ser Leu Asn His
164          340          345          350
166 Asn Gly Met Pro Val Ile Ser Lys Glu Glu Ala Val Asp Met Asp Phe
167          355          360          365
169 Phe Thr Lys Gln Ile Ile Thr Gly Arg Asp Val His Pro Gly Leu Phe
170          370          375          380
172 Ala Asn Trp Phe Thr Gly Gly Leu Asn Tyr Gln Ile Glu His His Leu
173 385          390          395          400
175 Phe Pro Ser Met Pro Arg His Asn Phe Ser Lys Ile Gln Pro Ala Val
176          405          410          415
178 Glu Thr Leu Cys Lys Lys Tyr Asn Val Arg Tyr His Thr Thr Gly Met
179          420          425          430
181 Ile Glu Gly Thr Ala Glu Val Phe Ser Arg Leu Asn Glu Val Ser Lys
182          435          440          445
184 Ala Ala Ser Lys Met Gly Lys Ala Gln
185 450          455
187 <210> SEQ ID NO: 3
188 <211> LENGTH: 1488
189 <212> TYPE: DNA
190 <213> ORGANISM: Mortierella alpina
192 <400> SEQUENCE: 3
193 gtccctgtgc gctgtcgcca caccocatcc tccctcgctc cctctgcggt tgccttggc 60
195 ccaccgtctc tctccacccc tccgagacga ctgcaactgt aatcaggaac cgacaaatac 120
197 acgatttctt tttactcagc accaactcaa aatcctcaac cgcaaccctt tttcaggatg 180
199 gcacctccca acactatcga tgccggtttg acccagcgtc atatcagcac ctcgccccca 240
201 aactcggcca agcctgcctt cgagcgcgaac taccagctcc ccgagttcac catcaaggag 300
203 atccgagagt gcatccctgc ccaactgctt gagcgctccg gtctccgtgg tctctgccac 360
205 gttgccatcg atctgacttg ggcgtcgctc ttgttcttgg ctgcgaccca gatcgacaag 420
207 tttgagaatc ccttgatccg ctatttggcc tggcctgttt actggatcat gcagggtatt 480
209 gtctgcaccg gtgtctgggt gctggctcac gagtgtggtc atcagtcctt ctcgacctcc 540
211 aagacctca acaacacagt tggttggatc ttgcactoga tgctcttggg cccctaccac 600
213 tcttgagaaa tctcgcactc gaagcaccac aaggccactg gccatatgac caaggaccag 660
215 gtctttgtgc ccaagaccgg ctcccagggt ggcttgctc ccaaggagaa cgctgctgct 720
217 gccgttcagg aggaggacat gtccgtgcac ctggatgagg aggctccat tgtgactttg 780
219 ttctggatgg tgatccagtt cttgttcgga tggcccgcgt acctgattat gaacgctct 840
221 ggccaagact acggccgctg gacctcgcac ttccacacgt actcgcccat ctttgagccc 900
223 cgcaactttt tcgacattat tatctcggac ctcggtgtgt tggctgccct cggtgccctg 960
225 atctatgcct ccattgcagt gtcgctcttg accgtcacca agtactatat tgtccctac 1020
227 ctctttgtca acttttgggt ggtcctgatc acctcttgc agcacaccga tcccaagctg 1080
229 cccattacc gcgagggtgc ctggaatttc cagcgtggag ctctttgcac cgttgaccgc 1140
231 tcgtttggca agttcttggc ccatatgttc cagcgattg tccacaccca tgtggcccat 1200
233 cacttgttct cgcaaatgcc gttctaccat gctgaggaag ctacctatca tctcaagaaa 1260
235 ctgctgggag agtactatgt gtacgaccca tccccgatcg tcgttgcggt ctggaggctg 1320
237 ttccgtgagt gccgattcgt ggaggatcag ggagacgtgg tctttttcaa gaagtaaaaa 1380
239 aaaagacaat ggaccacaca caacctgtc tctacagacc tacgtatcat gtagccatac 1440
241 cacttcataa aagaacatga gctctagagg cgtgtcattc gcgcctcc 1488

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244 <210> SEQ ID NO: 4
245 <211> LENGTH: 399
246 <212> TYPE: PRT
247 <213> ORGANISM: Mortierella alpina
249 <400> SEQUENCE: 4
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252 1 5 10 15
254 Ser Thr Ser Ala Pro Asn Ser Ala Lys Pro Ala Phe Glu Arg Asn Tyr
255 20 25 30
257 Gln Leu Pro Glu Phe Thr Ile Lys Glu Ile Arg Glu Cys Ile Pro Ala
258 35 40 45
260 His Cys Phe Glu Arg Ser Gly Leu Arg Gly Leu Cys His Val Ala Ile
261 50 55 60
263 Asp Leu Thr Trp Ala Ser Leu Leu Phe Leu Ala Ala Thr Gln Ile Asp
264 65 70 75 80
266 Lys Phe Glu Asn Pro Leu Ile Arg Tyr Leu Ala Trp Pro Val Tyr Trp
267 85 90 95
269 Ile Met Gln Gly Ile Val Cys Thr Gly Val Trp Val Leu Ala His Glu
270 100 105 110
272 Cys Gly His Gln Ser Phe Ser Thr Ser Lys Thr Leu Asn Asn Thr Val
273 115 120 125
275 Gly Trp Ile Leu His Ser Met Leu Leu Val Pro Tyr His Ser Trp Arg
276 130 135 140
278 Ile Ser His Ser Lys His His Lys Ala Thr Gly His Met Thr Lys Asp
279 145 150 155 160
281 Gln Val Phe Val Pro Lys Thr Arg Ser Gln Val Gly Leu Pro Pro Lys
282 165 170 175
284 Glu Asn Ala Ala Ala Val Gln Glu Glu Asp Met Ser Val His Leu
285 180 185 190
287 Asp Glu Glu Ala Pro Ile Val Thr Leu Phe Trp Met Val Ile Gln Phe
288 195 200 205
290 Leu Phe Gly Trp Pro Ala Tyr Leu Ile Met Asn Ala Ser Gly Gln Asp
291 210 215 220
293 Tyr Gly Arg Trp Thr Ser His Phe His Thr Tyr Ser Pro Ile Phe Glu
294 225 230 235 240
296 Pro Arg Asn Phe Phe Asp Ile Ile Ile Ser Asp Leu Gly Val Leu Ala
297 245 250 255
299 Ala Leu Gly Ala Leu Ile Tyr Ala Ser Met Gln Leu Ser Leu Leu Thr
300 260 265 270
302 Val Thr Lys Tyr Tyr Ile Val Pro Tyr Leu Phe Val Asn Phe Trp Leu
303 275 280 285
305 Val Leu Ile Thr Phe Leu Gln His Thr Asp Pro Lys Leu Pro His Tyr
306 290 295 300
308 Arg Glu Gly Ala Trp Asn Phe Gln Arg Gly Ala Leu Cys Thr Val Asp
309 305 310 315 320
311 Arg Ser Phe Gly Lys Phe Leu Asp His Met Phe His Gly Ile Val His
312 325 330 335
314 Thr His Val Ala His His Leu Phe Ser Gln Met Pro Phe Tyr His Ala
315 340 345 350

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```

317 Glu Glu Ala Thr Tyr His Leu Lys Lys Leu Leu Gly Glu Tyr Tyr Val
318          355          360          365
320 Tyr Asp Pro Ser Pro Ile Val Val Ala Val Trp Arg Ser Phe Arg Glu
321      370          375          380
323 Cys Arg Phe Val Glu Asp Gln Gly Asp Val Val Phe Phe Lys Lys
324 385          390          395
326 <210> SEQ ID NO: 5
327 <211> LENGTH: 355
328 <212> TYPE: PRT
329 <213> ORGANISM: Mortierella alpina
331 <400> SEQUENCE: 5
333 Glu Val Arg Lys Leu Arg Thr Leu Phe Gln Ser Leu Gly Tyr Tyr Asp
334 1          5          10          15
336 Ser Ser Lys Ala Tyr Tyr Ala Phe Lys Val Ser Phe Asn Leu Cys Ile
337      20          25          30
339 Trp Gly Leu Ser Thr Val Ile Val Ala Lys Trp Gly Gln Thr Ser Thr
340      35          40          45
342 Leu Ala Asn Val Leu Ser Ala Ala Leu Leu Gly Leu Phe Trp Gln Gln
343      50          55          60
345 Cys Gly Trp Leu Ala His Asp Phe Leu His His Gln Val Phe Gln Asp
346 65          70          75          80
348 Arg Phe Trp Gly Asp Leu Phe Gly Ala Phe Leu Gly Gly Val Cys Gln
349      85          90          95
351 Gly Phe Ser Ser Ser Trp Trp Lys Asp Lys His Asn Thr His His Ala
352      100          105          110
354 Ala Pro Asn Val His Gly Glu Asp Pro Asp Ile Asp Thr His Pro Leu
355      115          120          125
357 Leu Thr Trp Ser Glu His Ala Leu Glu Met Phe Ser Asp Val Pro Asp
358      130          135          140
360 Glu Glu Leu Thr Arg Met Trp Ser Arg Phe Met Val Leu Asn Gln Thr
361 145          150          155          160
363 Trp Phe Tyr Phe Pro Ile Leu Ser Phe Ala Arg Leu Ser Trp Cys Leu
364      165          170          175
366 Gln Ser Ile Leu Phe Val Leu Pro Asn Gly Gln Ala His Lys Pro Ser
367      180          185          190
369 Gly Ala Arg Val Pro Ile Ser Leu Val Glu Gln Leu Ser Leu Ala Met
370      195          200          205
372 His Trp Thr Trp Tyr Leu Ala Thr Met Phe Leu Phe Ile Lys Asp Pro
373      210          215          220
375 Val Asn Met Leu Val Tyr Phe Leu Val Ser Gln Ala Val Cys Gly Asn
376 225          230          235          240
378 Leu Leu Ala Ile Val Phe Ser Leu Asn His Asn Gly Met Pro Val Ile
379      245          250          255
381 Ser Lys Glu Glu Ala Val Asp Met Asp Phe Phe Thr Lys Gln Ile Ile
382      260          265          270
384 Thr Gly Arg Asp Val His Pro Gly Leu Phe Ala Asn Trp Phe Thr Gly
385      275          280          285
387 Gly Leu Asn Tyr Gln Ile Glu His His Leu Phe Pro Ser Met Pro Arg
388      290          295          300

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Please Note:

Use of n and/or Xaa have been detected in the Sequence Listing. Please review the Sequence Listing to ensure that a corresponding explanation is presented in the <220> to <223> fields of each sequence which presents at least one n or Xaa.

VERIFICATION SUMMARY
PATENT APPLICATION: US/09/367,013B

DATE: 03/05/2001
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Input Set : A:\ES.txt
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L:16 M:271 C: Current Filing Date differs, Replaced Current Filing Date

L:418 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:6
L:421 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:6
L:424 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:6
L:504 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:8
L:507 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:8
L:525 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:8
L:559 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:9
L:627 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:11
L:826 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:20
L:841 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:21
L:855 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:21
L:857 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:21
L:873 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:22
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L:1458 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:34
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L:1520 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:35
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L:1529 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:35
L:1563 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:36
L:1624 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:37
L:1698 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:38
L:1701 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:38
L:1728 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:38
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L:1865 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:39
L:1871 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:39
L:1874 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:39
L:1877 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:39
L:1889 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:39
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L:1989 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40
L:2016 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40
L:2022 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40
L:2025 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40
L:2031 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40
L:2046 M:341 W: (46) "n" or "Xaa" used, for SEQ ID#:40